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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/768,611	01/29/2004	Eiji Hasegawa	P/29-1647	7083
2352	7590	01/10/2006		
OSTROLENK FABER GERB & SOFFEN 1180 AVENUE OF THE AMERICAS NEW YORK, NY 100368403			EXAMINER TOLEDO, FERNANDO L	
			ART UNIT 2823	PAPER NUMBER

DATE MAILED: 01/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/768,611	Applicant(s) HASEGAWA, EIJI	
	Examiner Fernando L. Toledo	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 October 2005.
 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 1-21 is/are rejected.
 7) ☐ Claim(s) _____ is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☒ The drawing(s) filed on 29 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1 – 3 and 5 – 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu et al. (US Patent Application Publication US 2003/0157773 A1) in view of Wolf and Tauber (Silicon Processing for the VLSI Era Volume 1: Process Technology).

2. In re claims 1, 13 and 21, Hu, in the US Patent Application Publication US 2003/0157773 A1; figures 1 – 6 and related text, discloses forming an oxide film (step 102) on a semiconductor substrate; introducing nitrogen into the oxide film (step 104); and thermally oxidizing the oxide film in a gas atmosphere containing oxygen (step 106); wherein the nitrogen concentration is non-uniform (figure 6).

3. Hu does not explicitly shows wherein the temperature during the thermally oxidizing is higher than the temperature of any other process performed later than the thermally oxidizing. However, Wolf and Tauber, in the textbook Silicon Processing for the VLSI Era Volume 1: Process Technology discloses that at 900°C unwanted doping will occurs and that processes should be done at no higher than 900°C. Also, if processes are higher, they should be done by RTP, which is typically 1100°C (page 57).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the RTP of Hu be the highest temperature of the entire process, since, it is carried out at 1100°C and, according to Wolf and Tauber, at temperatures higher than 900°C unwanted doping will occur.

4. In re claim 2, Hu discloses wherein the nitrogen includes activated nitrogen (§ 0020).
5. In re claim 3, Hu discloses wherein the atmosphere in the thermally oxidizing process contains at least one of O₂, O₃, activated oxygen, oxygen radicals and oxygen ions (§ 0025).
6. In re claim 5, Hu discloses further including oxy-nitriding process performing a thermal treatment process in an atmosphere contains at least oxygen and nitrogen after the thermally oxidizing process (§ 0025).
7. In re claim 6, Hu discloses wherein the thermally oxidizing process is performed in atmosphere containing at least oxygen and nitrogen (§ 0025).
8. In re claim 7, Hu discloses wherein the gas containing oxygen and nitrogen at least one gas of NO, N₂O, and NO₂ (§ 0025).
9. In re claim 8, Hu discloses wherein at least a portion of dangling bonds on a surface of the semiconductor substrate that exists at the interface between the semiconductor substrate and the oxide film is terminated by nitrogen (§ 0020).
10. In re claims 9, 10 and 15 – 18, Hu discloses wherein nitrogen is introduced in an interface between the oxide film and the semiconductor substrate at 1E11 to 7E14 atoms/cm² (§ 0020).
11. In re claims 11 and 12, Hu discloses wherein the semiconductor substrate is not exposed to the ambient air during the step of introducing nitrogen and the thermally oxidizing process (§ 0025).

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12. In re claim 14, Hu discloses a gate electrode formed on the oxide film, wherein the interface between the gate electrode and the oxide film is higher than the concentration of nitrogen within the oxide film (§ 0001).

13. In re claim 19, Hu discloses wherein the concentration of nitrogen in the oxide film is higher than the concentration of nitrogen within the interface between the oxide film and the semiconductor substrate (Figure 6).

14. In re claim 20, Hu discloses further comprising a gate electrode formed on the oxide film, nitrogen being free from substantial distribution into the gate electrode (§ 0026).

15. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hu as applied to claims 1 – 3 and 5 – 18 above.

Hu does not disclose wherein the pressure of oxygen is 0.075 to 250 Torr in the thermally oxidizing process. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxygen pressure at 0.075 to 250 Torr, to achieve a desired reaction rate, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges for effect result variables involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Note that the specification contains no disclosure of either the critical nature of the claimed pressure or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen pressure or upon another variable recited in a claim, the Applicant must show that the chosen pressure is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In addition, the selection of pressure, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited

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number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Response to Arguments

16. Applicant's arguments filed 27 October 2005 have been fully considered but they are not persuasive for the following reasons.

17. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

18. In regards to claim 13, Applicant contests that Hu does not teach a non-uniform nitrogen concentration in the oxide layer.

Examiner, respectfully submits that the specification of the instant application does not disclose, teach or even suggest that the concentration of nitrogen is non-uniform. In fact, the specification, in particular, figure 6 shows an exponential graph of the concentration of nitrogen versus the depth of the oxide layer, which is similar in representation to that of Hu. Also, an

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impurity would inherently diffused in a uniform pattern since the diffusion of any impurity is governed by the First and Second Fick's Law.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

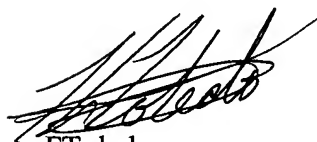
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando L. Toledo whose telephone number is 571-272-1867. The examiner can normally be reached on Mon-Thu 7am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

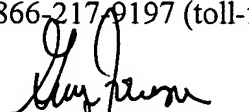
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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



FToledo

4 January 2006



George Fourson
Primary Examiner
Art Unit 2823